A330284

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

ENERGY ENGINEERING ANALYSIS PROGRAM STUDY

Holston Army Ammunition Plant

Kingsport, Tennessee

EXECUTIVE SUMMARY

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ENERGY ENGINEERING ANALYSIS PROGRAM STUDY
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

CONTRACT NO. DACA 01-81-C-0070

EXECUTIVE SUMMARY

Prepared by

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

For

MOBILE DISTRICT, CORPS OF ENGINEERS
MOBILE, ALABAMA

January 1983

ENERGY ENGINEERING ANALYSIS PROGRAM STUDY
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE
CONTRACT NO. DACA 01-81-C-0073

EXECUTIVE SUMMARY

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1.0 INTRODUCTION

This volume is a summary of the results of the Energy Engineering Analysis Program (EEAP) study for the Holston Army Ammunition Plant (HAAP).

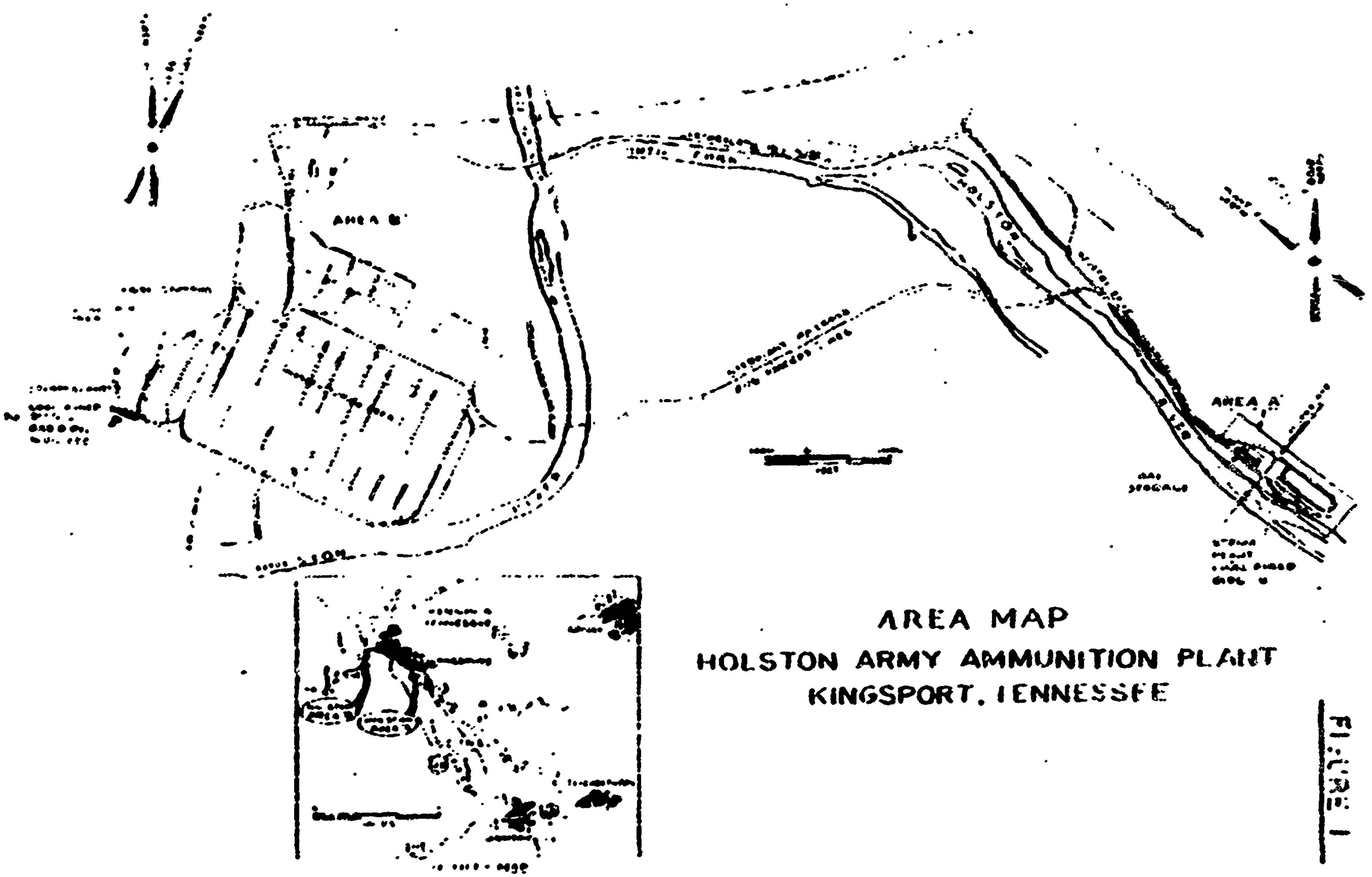
This EEAP includes energy conservation project recommendations and analyses that will result in a reduction in energy usage. This study also develops data necessary for the Installation Base-wide Energy Systems Plan.

The study effort is separated into the following increments:

Increment A - Buildings
Increment B - Utilities Distribution Systems and EMCS
Increment E - (Mod) - Central Boiler Plants
Increment F - Facilities Engineer Energy Conservation Measures
Increment G - Maintenance, Repair and Minor Construction

The HAAP is a Government-owned, contractor-operated (GOCO) military industrial installation under the jurisdiction of the U.S. Army Armament Materiel Readiness Command (ARRCOM), Rock Island, Illinois, built in the early 1940's for the manufacture of explosives as required by the Department of Defense. HAAP is presently operated by Holston Defense Corporation (HDC) at a reduced rate, with the inactive process buildings disconnected from the plant utility systems, but ready to be reactivated quickly in the event full or increased mobilization is required.

Geographically, the plant is divided into two parts known as Area A and Area B, see Figure 1. The total area originally consisted of approximately 6,503 acres (288 acres at Area A and 6,215 acres at Area B). Subsequent disposition has reduced



AREA MAP
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 1

Area A to approximately 112 acres, and Area B to approximately 5,913 acres, or a total of 6,025 acres.

Area A is located within the city limits of Kingsport, Tennessee. Area B is located in Hawkins County, Tennessee, 5 miles west of downtown Kingsport, along U. S. route 11-W. The two areas are interconnected by a narrow corridor which contains two acid pipelines, a railroad and a liquid waste line.

Area A is used for the concentration of weak acetic acid into glacial acetic acid and for the production of acetic anhydride. The acetic anhydride is pumped into Area B where explosives are produced. Area B has ten separate explosives production lines with their required supporting facilities. Recovered explosivesfree acetic acid is pumped to Area A for reprocessing. Currently, the equivalent of approximately two explosives production lines with necessary support facilties are in operation. The present operating staff of the facility is made up of 1,107 people, including two military and 38 civilian army staff.

As originally constructed, HAAP consisted of 553 buildings. However, since the time of completion, the total number of buildings or facilities has been reduced to 333 (not including 141 explosives magazines).

The 333 buildings currently at the plant include 207 buildings which are presently either closed, laid away or otherwise not included in this energy report but which are maintained in readiness for quick activation in the event that increased production rates are required, leaving 126 active buildings with a total floor area of 99,263 square feet. Table I presents the Building Data Sheets, see Pages 6 through 17.

The majority of the active process buildings operate on a 24 hour day, 7 days per week, during which time heat radiated from pipes and process equipment is more than adequate for building heating. The heating systems for these buildings are required only during shutdown periods as freeze protection for water lines and wet type fire protection systems. No significant energy can be saved in these buildings if we exclude process systems.

Original maintenance and office buildings are wood frame construction, no wall insulation, and 6 to 8 inches loose ceiling insulation, with gravity ventilated attic spaces. Some buildings have uninsulated wood floors over ventilated crawl spaces. These buildings are mainly heated by steam cast-iron radiators with manual control. Steam is supplied to most buildings from central steam plants, with the more remote buildings having oil-fired furnaces. Air-conditioning is provided primarily by window type air-conditioning units, except for a few central air-conditioning units using direct expansion coils and air-cooled condensers.

Newer office and service buildings are centrally air-conditioned, Butler type insulated metal buildings or insulated curtain wall construction.

The general level of maintenance at the plant is good and leaves few areas for improvement.

Inspection of the steam distribution system revealed no gaps or breaks in the insulation, except that steam lines were uninsulated downstream of the isolation valves in the inactive production areas.

The central boiler plants in Area A and B are in very good condition even though they are almost 40 years old. The coal-fired boilers have been [illegible]

excellent operating condition except for a tube thinning problem at the stoker line of the Area A boilers. Because of their original conservative design, the boilers represent systems equal to or better than present new boiler installations. After a boiler is fired at or near its capacity for a period of a year or more, as would be the case in a full mobilization, the boiler should be inspected by a recognized boiler inspector to determine its capability to handle future full load demands.

HDC, the civilian operating contractor, has done extensive work to reduce energy usage from the base year 1975. Fiscal year 1981 shows a reduction on the order of 40 percent from the base year, as opposed to the federal target range of 20 percent reduction by FY 1985 and 40 percent by FY 2000.

The general level of enthusiasm for energy conservation appears to be quite high, and is maintained at this level by programs sponsored by the operating contractor and the civilian army staff.

A. M. Kinney, Inc.

AREA "A"

Date 8-25-82

Date 8-30-82

BUILDING DATA SHEET
PAGE 1 OF 12

COLUMN NO'S

TABLE 1 - BUILDING DATA SHEETS - PART 1

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
BLDG. NO	NAME	NO FLOORS	YEAR BUILT	CONSTRUCTION					U VALUE					WINDOW AREA	DOOR AREA	FLOOR AREA
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	SQ. FEET	SQ FEET	SQ FEET
1	[illegible] ADMINISTRATION	1	1963	ASPHALT SHINGLE	MASONRY	CONCRETE	METAL D.H.	INSUL. METAL	.075	.070	--	1.10	.67	272	91	5520
[illegible]	[illegible]	2	1963	[illegible] CONCRETE	MASONRY	CONCRETE	METAL AWNING	HOLL. METAL	.025	.070	--	1.10	.67	030	217	6572
[illegible]	[illegible]	1	1963	B.U. [illegible]	MASONRY	CONCRETE	METAL, AWNING	INSUL. METAL	.005	.017	--	1.10	.67	2630	107	8052
[illegible]	[illegible] BUILDING	6	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL	.035	[illegible]	--	1.10	1.00	3729	310	64204
7	[illegible] BUILDING	3	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL	[illegible]	.017	--	1.10	1.00	2907	092	122960
[illegible]	[illegible] PLANT	2 & BSMT.	1949	B.U. [illegible]	MASONRY	CONCRETE	METAL AWNING	METAL	.025	.059	--	1.10	1.00	6000	100	59230
[illegible]	[illegible]	1 & 2	[illegible]	B.U. [illegible]	MASONRY	CONCRETE	[illegible] AWNING	INSUL. METAL	.005	.017	--	1.10	1.00	0110	054	11200
10	[illegible]	[illegible]	[illegible]	B.U. WOOD	WOOD FRAME	CONCRETE	METAL AWNING	INSUL. METAL	.005	.500	--	1.10	.67	003	130	5004
11	PUMP HOUSE	[illegible]	[illegible]	B.U. CONCRETE	CONCRETE	CONCRETE	METAL AWNING	METAL	.025	.070	--	1.10	1.00	106	00	7906
12	[illegible]	2	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	WOOD	.025	.070	--	1.10	.67	36	42	2962
[illegible]	[illegible]	1	1963	METAL SHEET	MASONRY	CONCRETE	METAL AWNING	INSUL. METAL	.312	.075	--	1.10	.59	1100	294	6470
[illegible]	[illegible]	3	1963	B.U. WOOD	WOOD FRAME	CONCRETE	METAL AWNING	INSUL. METAL	.005	.500	--	1.10	.67	1501	303	10151
[illegible]	[illegible]	1	1963	ASPHALT SHINGLE	WOOD [illegible]	CONCRETE	METAL AWNING	INSUL. METAL	.075	.066	--	0.10	.67	1054	432	6022
[illegible]	[illegible]	2	1963	METAL SHEET	WOOD FRAME	[illegible]	METAL AWNING	INSUL. METAL	.059	.100	--	1.10	.59	462	62	3650
[illegible]	[illegible]	3	1960	ASPHALT SHINGLE	WOOD FRAME	CONCRETE	METAL AWNING	WOOD	.312	.320	--	1.10	.59	253	04	1000
[illegible]	[illegible]	1	1960	METAL SHEET	CONCRETE BLOCK	CONCRETE	METAL AWNING	INSUL. METAL	.370	.017	--	1.10	.67	100	239	1700
[illegible]	[illegible]	1	1973	[illegible]	CONCRETE	CONCRETE	--	METAL	--	--	--	--	--	--	--	--
[illegible]	[illegible]	1	1973	STEEL [illegible]	[illegible]	[illegible]	METAL AWNING	METAL O'HEAD	.007	.017	--	1.19	1.00	636	600	6109
[illegible]	[illegible]	1	1965	METAL SHEET	WOOD [illegible]	[illegible]	METAL AWNING	INSUL. METAL	.170	.500	--	1.10	.67	200	106	2300

FOR CONTINUATION, SEE PART 2, PAGE 2 OF 12

[illegible] AAF
[illegible], TENN.
BUILDING DATA

A. M. KINNEY, INC.
[illegible]
[illegible]
[illegible] "B"

[illegible] 9-371 [illegible]
[illegible] 8-25-83
[illegible] 8-18-83

BUILDING DATA SHEET
PAGE 3 OF 11

TABLE 1 - BUILDING DATA SHEETS - PART 2

COLUMN NO'S

(1)	(2)	⑱	⑲	⑳	㉑	㉒	㉓	㉔	㉕	㉖	㉗	㉘	㉙	㉚
BLDG NO	NAME	COOLING		HEATING		PEAK [illegible] LOAD		DOMESTIC HOT WATER		CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
		SYSTEM	CAPACITY	SYSTEM	FUEL	GAIN	LOSS	CAPACITY	FUEL					
1	[illegible]	[illegible] A.C.	--	[illegible]	STEAM	--	104,000	40 GAL.	STEAM	10.2	48.9	35.4	16,235	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	CONT.	--	--	10.9	16.9	53.0	15,500	
[illegible]	[illegible]	--	--	U.S.	STEAM	--	CONT.	--	-	676.2	54.0	[illegible]	339,621	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	CONT.	--	--	700.0	97.4	[illegible]	364,070	SPOT HEATING
[illegible]	[illegible]	--	--	U.H.	STEAM	-	CONT.	--	-	1545.0	364.4	1443.6	1339,734	SPOT HEATING
[illegible]	STEAM PLANT	--	--	U.H.	STEAM	--	CONT.	--	--	850.0	30.0	331.2	973,[illegible]	SPOT HEATING
[illegible]	[illegible] PLANT	--	--	U.H. & CONVECT	STEAM	--	171,310	30 GAL.	ELECT.	400.2	19.6	230.5	965,310	
[illegible]	[illegible]	-	--	U.H.	STEAM	--	CONT.	--	--	233.1	18.0	173.0	310,025	
[illegible]	[illegible]	-	--	U.H.	STEAM	--	227,000	--	--	1532.7	92.7	165.9	1359,025	
[illegible]	[illegible]		--	[illegible]	OIL	--	65,375	--	--	14.7	14.7	12.3	1,375	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	410,190	60 GAL.	ELECT.	17.0	17.6	15.3	0,000	
[illegible]	[illegible]	[illegible] A.C.	--	U.H. & CONVECT	STEAM	--	1061,55	--	--	23.6	23.6	28.2	26,015	
[illegible]	[illegible]	[illegible] A.C.	--	U.H. & CONVECT	STEAM	--	260,63	30 GAL.	ELECT.	20.0	20.0	20.1	33,093	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	-	210,61	30 GAL.	ELECT.	16.0	16.9	10.4	0,380	
[illegible]	[illegible]	[illegible] A.C.	--	U.H. & CONVECT	STEAM	--	175,20	40 GAL.	ELECT.	33.5	33.5	19.4	13,900	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	200,90	100 GAL.	STEAM	30.0	13.0	10.9	[illegible]	
[illegible]	[illegible]	--	--	--		-	--	--	--	50.0	0	23.0	52,500	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	360,73	50 GAL.	ELECT.	70.3	27.3	66.7	13,017	
[illegible]	[illegible] SHOP	--	--	U.H.	STEAM	--	390,00	30 GAL.	ELECT.	25.4	3.5	22.9	3,20	

[illegible] [illegible] LAP　　A. M. KINNEY, INC.　　[illegible]　　[illegible]
[illegible] [illegible], TENN.　　CONSULTING ENGINEERS　　Checked JAG　　Date 8-25-83
[illegible] BUILDING DATA　　AREA "B"　　Computed [illegible]　　Date 8-16-83

BUILDING DATA SHEET
PAGE 1 OF 13

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
				CONSTRUCTION					"U" VALUE					WINDOW AREA	DOOR AREA	FLOOR AREA
BLDG NO	NAME	NO. FLOORS	YEAR BUILT	ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	SQ FEET	SQ FEET	SQ FEET
2	[illegible]	1	1941	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL D.H.	HOLLOW METAL	.332	.110	.369	1.10	.59	651	175	12,996
[illegible]	[illegible]	1	1900	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL AWNING	HOLLOW METAL	.079	.110	.300	1.10	.59	1664	229	9,984
[illegible]	[illegible]	1	1939	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL D.H.	HOLLOW METAL	.312	.110	.309	1.10	.59	1130	201	14,300
[illegible]	[illegible] HALL	1	1943	METAL ON WOOD	WOOD FRAME	[illegible]	METAL AWNING	METAL O'HEAD	.079	.110	--	1.10	.59 1.04	934	84 420	2,872
[illegible]	[illegible]	1	1943	METAL ON WOOD	MASONRY	CONCRETE	METAL AWNING	HOLLOW METAL	.070	.078	--	1.10	.59	1878	85	17,702
[illegible]	[illegible]	1	1943	B.U. ON WOOD	CONCRETE BLOCK	CONCRETE	METAL AWNING	HOLLOW METAL	.085	.211	--	1.10	.59	292	139	3,067
[illegible]	[illegible]	1	1944	B.U. ON WOOD	MASONRY	CONCRETE	--	HOLLOW METAL	.085	.178	--	1.10	.59	--	77	323
[illegible]	[illegible]	1	1933	B.U. ON CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL O'HEAD	.030	.072	--	1.10	.59 1.04	36	28 170	3,547
[illegible]	TRAINING	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.070	.160	--	1.04	.50	658	420	9,112
20	[illegible]	1	1943	--	--	--	--	--	-	--	--	--	--	--	--	--
[illegible]	ADMINISTRATION	1	1900	B.U. ON METAL [illegible]	PORCELAIN PANEL	CONCRETE	[illegible] GLASS	GLASS	.090	.031	--	0.56	0.85	3778	627	60,023
100	[illegible] & METAL SHOP	1	1951	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	METAL O'HEAD	.085	.360	--	1.10	.59 1.04	2618	176 550	25,135
[illegible]	GENERAL STORES	1	1941	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.085	.363	--	1.10	.59	[illegible]	531	16,095
102	[illegible] & [illegible]	[illegible]	1943	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.085	.300	--	1.10	.59	1904	582	24,935
103	[illegible]	1	1943	B.U. ON WOOD	STEEL FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.035	.300	--	1.10	.53	1019	500	13,120
[illegible]	[illegible] SHOP	1	1949	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.370	.110	--	1.10	.50	592	460	4,200
[illegible]	SERVICE STATION	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	METAL O'HEAD	.079	.310	--	1.10	.55 1.04	736	35 615	5,050
[illegible]	[illegible]	1	1941	B.U. ON [illegible]	WOOD FRAME	CONCRETE	METAL AWNING	HOLLOW METAL	.305	.318	--	1.10	.59	1200	213	9,052
[illegible]	[illegible]	1	1943	B.U. ON WOOD	MASONRY	CONCRETE	METAL AWNING	HOLLOW METAL	.332	.470	--	1.10	.59	654	362	6,317

FOR CONTINUATION, SEE PART 2 PAGE 6 OF 12

[illegible]
[illegible], TENNESSEE
BUILDING DATA

A. M. KINNEY, INC.
[illegible]
AREA "B"

[illegible]
[illegible] 8-?-82
[illegible] 8-16-82

BUILDING DATA SHEETS
PAGE 8 OF 11

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG NO	NAME	COOLING		HEATING		PEAK TRANS LOAD		DOMESTIC HOT WATER		CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
		SYSTEM	CAPACITY	SYSTEM	FUEL	GAIN	LOSS	CAPACITY	FUEL					
1	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	603,369	50 GAL	STEAM	61.9	60.3	48.[illegible]	12,69[illegible]	
2	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	554,475	50 GAL	ELECT	13.2	44.8	35.[illegible]	17,69[illegible]	
4	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	900,534	50 GAL	ELECT	35.3	13.3	26.[illegible]	30,60[illegible]	
5	[illegible]	WINDOW A.C.	--	FORCED AIR	OIL	--	520,636	60 GAL	ELECT	33.0	16.5	25.[illegible]	20,9[illegible]	
9	LABORATORY	WINDOW A.C.	--	CONVECT	STEAM	--	610,649	100 GAL	STEAM	166.6	73.0	174.[illegible]	90,5[illegible]	
60	[illegible]	--	--	U.H. CONVECT	STEAM	--	277,992	--	--	50.6	33.9	60.[illegible]	20,39[illegible]	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	19,070	--	--	6.0	5.2	6.[illegible]	72[illegible]	
7	[illegible]	--	--	FORCED AIR	OIL	--	117,999	--	--	9.9	8.8	0.[illegible]	36[illegible]	
87	[illegible]	CENTRAL [illegible]	272,999	FORCED AIR	STEAM	180,670	182,294	30 GAL	ELECT	55.4	17.7	31.[illegible]	40,20[illegible]	
90	[illegible]	--	--	--	--	--	--	--	--	--	--	--	--	
96	ADMINISTRATION	CHILLED WATER	135[illegible]	FORCED AIR	HOT WATER	806,512	1500,[illegible]	50 GAL	ELECT	619.6	310.0	561.[illegible]	770,00[illegible]	
100	[illegible]	WINDOW A.C.	--	U.H. & CONVECT	STEAM	--	6196,535	26 GAL	ELECT	699.2	49.7	320.[illegible]	203,90[illegible]	
10[illegible]	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	1000,603	--	--	48.1	70.7	50.[illegible]	12,00[illegible]	
104	[illegible] SHOP	--	--	U.H.	ELECT	--	2119,864	52 GAL	ELECT	76.0	30.0	60.[illegible]	30,52[illegible]	
121	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	2345,652	--	--	95.6	21.7	10.[illegible]	0,20[illegible]	
144	[illegible]	--	--	U.H. & CONVECT	STEAM	--	666,780	--	--	77.4	10.9	30.[illegible]	60,27[illegible]	
105	[illegible] STATION	--	--	U.H.	STEAM	--	396,445	52 GAL	ELECT	17.4	21.6	12.[illegible]	40,00[illegible]	
109	[illegible]	--	--	U.H. & CONVECT	STEAM	--	975,614	1600 GAL	STEAM	616.6	49.6	87.[illegible]	60,23[illegible]	
140	[illegible]	--	--	U.H.	STEAM	--	341,190	30 GPH	STEAM	11.3	11.2	28.[illegible]	24,22[illegible]	

[illegible]
[illegible], TENN.
[illegible]

A. M. KINNEY, INC.
[illegible]
AREA "B"

[illegible] 02531 [illegible]
[illegible] 8-25-82
[illegible] 9-16-82

BUILDING DATA SHEET
PAGE 5 OF 12

COLUMN NO'S

PART I - (CONTINUED) BUILDING DATA SHEET - PART I

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰
				CONSTRUCTION					"U" VALUE							
BLDG. NO	NAME	NO FLOORS	YEAR BUILT	ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	WINDOW AREA SQ FEET	DOOR AREA SQ FEET	FLOOR AREA SQ. FEET
[illegible]	[illegible]	1	1941	B.U. ON WOOD	WOOD FRAME	CONC.	METAL [illegible]	GLASS	.100 .079	.180	--	1.10	.67	319	360	6760
[illegible]	[illegible]	1	1942	B.U. ON WOOD	[illegible]	CONC.	METAL AWNING	WOOD	.035	.510	--	[illegible]	.67 1.04	427	42 304	2562
[illegible]	[illegible]	1	1950	STEEL W/INSUL.	STEEL W/INSUL.	CONC.	--	[illegible] METAL O'	.240	.67	--	--	0.67 1.04	--	42 112	2152
[illegible]	[illegible]	1	1962	[illegible]	[illegible]	CONC.	[illegible]	[illegible]	.315	.417	--	1.10	1.10	228	193	227
[illegible]	[illegible]	1	1966	CORR. METAL	[illegible] METAL	CONC.	METAL [illegible]	[illegible] METAL	.060	.060	--	1.26	.67	300	105	8790
[illegible]	[illegible]	1	1967	STEEL	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.100	.192	--	1.10	.30	120	294	9040
[illegible]	[illegible]	1	1900	[illegible]	STEEL	CONC.	METAL AWNING	[illegible] METAL	.019	.192	--	1.00	.30	36	116	6555
[illegible]	[illegible]	2	1970	[illegible]	[illegible]	CONC.	METAL AWNING	GLASS	.100	.170	--	1.10	.67	330	215	6735
[illegible]	[illegible]	[illegible]	1971	[illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.100	.069	--	1.10	.30	427	179	9960
[illegible]	[illegible]	1	1975	[illegible] METAL [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.020	.13	--	1.06	.30	570	125	16386
[illegible]	[illegible]	1	1975	[illegible] METAL [illegible]	[illegible]	CONC.	METAL [illegible]	[illegible]	.050	.15 .192	--	1.06	.67	446	706	[illegible]
[illegible]	[illegible]	1	1970	[illegible] METAL [illegible]	[illegible]	CONC.	METAL AWNING	METAL METAL O'	.030	.510	--	1.06	.67 1.04	24	121	606
[illegible]	[illegible]	[illegible]	1941	[illegible]	MASONRY	CONC.	METAL AWNING	METAL METAL O'	.025	.417	--	1.10	.67 1.04	1200	780	[illegible]
[illegible]	[illegible]	2	1963	[illegible]	[illegible]	CONC.	METAL AWNING	METAL METAL O'	.515	.069	--	1.10	.67 1.04	2006	203	[illegible]
[illegible]	[illegible]	2	1959	[illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.015	.037	--	1.10	.30	33	103	1,600
[illegible]	[illegible]	1	1962	[illegible] STEEL	MASONRY	CONC.	METAL [illegible]	[illegible]	.052	.070	--	1.10	.67	661	212	3,020
[illegible]	[illegible]	1	--	[illegible]	[illegible] STEEL	WOOD	--	[illegible]	--	--	--	--	--	--	--	303
[illegible]	[illegible]	1	1962	[illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.025	.037	--	1.10	.30	100	57	[illegible]
[illegible]	[illegible]	1		[illegible] STEEL	[illegible] STEEL	WOOD	--	WOOD	--	--	--	--	--	--	--	201
[illegible]	[illegible]	1	--	[illegible] STEEL	[illegible] STEEL	WOOD	--	WOOD	--	--	--	--	--	--	--	192
[illegible]	[illegible]	1	1972	[illegible] STEEL	[illegible]	CONC.	--	WOOD	--	--	--	--	--	--	--	400
[illegible]	[illegible]	2	1972	[illegible]	[illegible]	CONC.	97	[illegible] METAL O'	.100	.070	--	1.10	.67 1.04	60	65 255	3,300
[illegible]	[illegible]	1	1972	[illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.007	.012	--	1.10	.36	66	207	2,236

FOR CONTINUATION, SEE PART 2, PAGE 6 OF 12

A. M. Kinney, Inc.

BUILDING DATA SHEET

PAGE [illegible] OF 12

[illegible] BUILDING DATA — [illegible] 9/19/82

COLUMN NO'S

TABLE 1 – (CONTINUED) BUILDING DATA SHEETS – PART 4

(1) BLDG. NO	(2) NAME	(18) COOLING SYSTEM	(19) COOLING CAPACITY	(20) HEATING SYSTEM	(21) HEATING FUEL	(22) PEAK TRANS LOAD GAIN	(23) PEAK TRANS LOAD LOSS	(24) DOMESTIC HOT WATER CAPACITY	(25) DOMESTIC HOT WATER FUEL	(26) CONNECT LOAD KW	(27) LIGHTING LOAD KW	(28) DEMAND KW	(29) ANNUAL USAGE KWH	(30) REMARKS
110	[illegible]	CENTRAL W.S.	120,000	U.S. & CONV.	STEAM	-	102,170	27 GAL	STEAM	42.3	36.3	80.0	41,090	
[illegible]	[illegible]	--	--	W.H. & CONV.	STEAM	--	175,073	6 GAL	ELEC	15.6	10.4	20.8	36,500	
210	[illegible]	-		U.S.	STEAM	-	120,008	--	-	5.1	5.1	--	--	STORAGE
222	[illegible]	--		CONV.	ELEC.	--	54,235	33 GAL	ELEC.	7.8	2.8	2.8	38,385	
227	[illegible]	CENTRAL W.S.	120,000	FORCED AIR	STEAM	30,796	198,111	47 GAL	ELEC	43.7	22.3	39.4	56,010	
235	[illegible]	WINDOW A.C.	--	FAN COIL	STEAM	-	122,222	52 GAL	ELEC	33.4	11.6	19.4	17,129	
236	DATA PROCESSING	CENTRAL W.S.	607,000	FORCED AIR	GAS STEAM	196,011	133,039	16 GAL	ELEC.	93.0	40.1	31.5	98,188	
[illegible]	[illegible]	WINDOW A.C.		U.S.	ELEC. STEAM	-	200,907	-	--	30.7	23.8	25.8	3,189	
[illegible]	[illegible]		--	W.H. CONV. & FORCED	STEAM	--	089,999	--	-	47.9	25.4	11.2	1,382	
[illegible]	[illegible]	CENTRAL W.S.	600,003	AIR	ELEC.	123,831	300,814	70 GAL	ELEC.	149.9	85.3	220.8	253,515	
[illegible]	[illegible]	CENTRAL W.S.	170,000	UNIT VENT	STEAM	477,001	303,570	50 GAL	ELEC.	173.5	98.5	180.0	120,919	
[illegible]	[illegible]	--	--	W.H. CONV.	STEAM		64,520	31 GAL	ELEC.	27.3	9.3	7.8	3,700	
400	STEAM PLANT	--	--	W.H.	STEAM	-	[illegible]	--	--	430.0	36.0	330.1	870,200	
[illegible]	[illegible] PLANT	WINDOW A.C.	--	W.H. CONV.	OIL	-	653,038	43 GAL	ELEC.	65.9	11.6	39.1	144,120	
[illegible]	[illegible]	--	--	C.H.	ELEC		35,000	--	-	133.8	74.3	102.4	365,910	
[illegible]	[illegible]	--	--	W.H.	STEAM	-	236,951	82 GAL	ELEC	26.3	17.0	23.5	11,072	
240	[illegible]	--	-	-	-	-	--	--	-	20.3	5.5	23.5	5,882	
[illegible]	[illegible]	--	--	W.H.	ELEC.	-	89,070	--	-	64.2	8.2	10.1	2,285	
225	[illegible]	--	--	-			--	--	-	20.3	5.5	23.5	2,883	
226	[illegible]	--	--	-			--	--	--	20.3	5.5	23.5	5,883	
[illegible]	[illegible]	--	--				--	--	--	20.3	5.5	23.7	5,883	
[illegible]	[illegible]		--	W.H.	GAS	--	100,087	6 GAL	ELEC	34.0	16.0	33.1	3,355	
[illegible]	[illegible]	-	--	W.H.	STEAM		85,030	--	--	181.3	27.5	395.1	101,010	

[illegible] [illegible]
[illegible] [illegible], [illegible]
[illegible] [illegible] DATA

A. M. K[illegible], INC.
[illegible]
[illegible] "B"

[illegible] [illegible]
[illegible] [illegible] 8/23/82
[illegible] [illegible] 8/10/82

BUILDING DATA SHEET
PAGE 2 OF 12

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

COLUMN NO'S

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
BLDG NO	NAME	NO STORIES	YEAR BUILT	CONSTRUCTION					"U" VALUE					WINDOW AREA SQ. FEET	DOOR AREA SQ. FEET	FLOOR AREA SQ. FEET
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR			
[illegible]	[illegible] ST.	4	1902	B.U. [illegible]	[illegible]	CONC.	--	METAL	0.10	0.332	--	--	0.70	7,54[illegible]	305	2,760
[illegible]	[illegible]	1	1942	[illegible]	[illegible]	CONC.	--	METAL	0.30	0.342	--	--	0.70	4,90[illegible]	126	2,020
[illegible]	[illegible]	2	1942	[illegible]	MASONRY	CONC.	METAL GLASS	WOOD	0.090 0.100	.270	0.300 0.260	.568	.67	36[illegible]	1174	21,330
[illegible]	[illegible]	1	1924	[illegible]	[illegible]	[illegible]	METAL AWNING	METAL	0.435	.900	--	1.10	.5[illegible]	10[illegible]	210	9,320
[illegible]	[illegible]	1	1958	[illegible]	[illegible]	[illegible]	--	METAL	0.315	0.[illegible]	--	--	.55	--	80	630
[illegible]	[illegible]	1	1943	METAL [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.100	.070	--	1.10	.55	95[illegible]	48	2,110
[illegible]	[illegible]	1	1946	METAL [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.570	.909	--	1.10	.55	121	263	3,901
[illegible]	[illegible]	1	1942	METAL [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.533	.414	--	1.10	.55	30[illegible]	205	4,604
[illegible]	[illegible]	1	1943	METAL [illegible]	[illegible]	[illegible]	METAL AWNING	[illegible]	.672	.112	--	2.06	.6[illegible]	22	52	2,541
[illegible]	[illegible]	1	1942	STEEL	[illegible]	[illegible]	METAL AWNING	[illegible] METAL	.493	.300	--	1.10	.52	36[illegible]	80	3,321
[illegible]	[illegible]	1	1967	B.U. ON [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.100	.329	--	1.10	.55	5	82	504
[illegible]	[illegible]	1	1972	[illegible]	[illegible]	[illegible]	METAL AWNING	METAL [illegible]	.043	.069	--	1.10	.55 1.04	23[illegible]	40 336	4,320
[illegible]	[illegible]	1	1942	B.U. ON [illegible]	[illegible]	[illegible]	METAL AWNING	WOOD [illegible]	.132	.300	--	1.10	0.63 1.04	19[illegible]	40 1720	10,650
[illegible]	[illegible]	1	1942	B.U. ON [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.435	.310	--	1.10	.55	21[illegible]	80	6,210
[illegible]	[illegible]	1	1942	METAL [illegible]	[illegible]	CONC.	WOOD D.H.	[illegible] METAL	.039	.310	--	1.10	.55	10[illegible]	81	1,072
[illegible]	[illegible]	1	1942	B.U. ON [illegible]	[illegible]	CONC.	METAL AWNING	[illegible]	.435	.317	--	1.12	.6[illegible]	6	80	772
[illegible]	[illegible]	6	1962	B.U. ON [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.435	.071	--	1.10	.5[illegible]	4,024	232	7,204
[illegible]	[illegible]	6	1962	B.U. ON [illegible]	[illegible]	CONC.	METAL AWNING	[illegible] METAL	.300	.011	--	1.10	.5[illegible]	4,024	232	7,204
[illegible]	[illegible]	2	1962	B.U. ON WOOD	MASONRY	CONC.	WOOD D.H.	WOOD	.095 .025	.017	--	1.10	.5	1,430	226	5,40[illegible]
[illegible]	[illegible]	2	1962	B.U. ON WOOD	MASONRY	CONC.	WOOD D.H.	WOOD	.035 .025	.017	--	1.10	.5	1,050	226	5,400

FOR CONTINUATION, SEE PART 2, PAGE 8 OF 12

[illegible] [illegible]
[illegible] [illegible]
[illegible] BUILDING DATA

A. M. KINNEY, INC.
[illegible]
AREA "B"

[illegible] [illegible]
[illegible] JHS [illegible] 8/23/82
[illegible] [illegible] 8/16/82

BUILDING DATA SHEET
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COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

(1) BLDG NO.	(2) NAME	(18) COOLING SYSTEM	(19) COOLING CAPACITY	(20) HEATING SYSTEM	(21) HEATING FUEL	(22) PEAK TRANS LOAD GAIN	(23) PEAK TRANS LOAD LOSS	(24) DOMESTIC HOT WATER CAPACITY	(25) DOMESTIC HOT WATER FUEL	(26) CONNECT LOAD KW	(27) LIGHTING LOAD KW	(28) DEMAND KW	(29) ANNUAL USAGE KWH	(30) REMARKS
111	[illegible] WASTE PUMP [illegible]	--	--	U.H.	ELECT.	--	40,003	--	--	119.9	9.0	110.5	30,[illegible]	
210	[illegible] WASTE PUMP [illegible]	--	--	U.H.	ELECT.	--	46,140	--	--	200.0	2.0	100.2	80,900	
233	WATER TREATMENT	CENTRAL D.X.	420,200	U.H. & FCU AIR	ELECT.	430,[illegible]	726,360	120 GAL.	ELECT.	3,209.5	20.1	3,100.4	7,034,000	
302	AMMONIA [illegible]	-	--	U.H.	STEAM	--	206,031	--	--	42.5	6.3	36.1	206,63[illegible]	
302	PUMP HOUSE	--	--	U.H.	STEAM	--	60,003	--	--	12.0	6.0	0.9	5,62[illegible]	
313	OFFICE & LAB [illegible]	WINDOW A.C.	--	U.H. & FCU AIR	STEAM	--	050,372	30 GAL.	ELEC	16.0	7.1	13.1	9,712	
321	REPAIR SHOP & [illegible]	--	--	UH & CONV.	ELEC STEAM	--	372,235	--	--	12.0	6.5	10.0	6,200	
322	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	318,095	60 GAL.	STEAM	39.2	29.2	26.1	11,195	
330	[illegible] AREA OFFICE	CENTRAL D.X.	190,000	CONV. & FCU AIR	STEAM	137,400	90,100	32 GAL.	ELECT.	25.2	11.7	22.7	13,105	
390	[illegible]	--	-	CONV.	STEAM	--	191,030	--	--	770.3	32.9	520.9	401,625	
393	[illegible]	--	--	U.H.	ELEC.	-	65,000	--	--	[illegible]	[illegible]	[illegible]	[illegible]	
395	MAINTENANCE SHOP	--	--	U.H. & CONV.	STEAM	-	203,903	50 GAL.	ELECT.	101.0	14.7	91.6	92,915	
376	HEAVY EQUIP. SHOP	--	--	U.H. & CONV.	STEAM	-	907,600	--	--	130.0	80.3	111.0	201,700	
500	[illegible] BUILDING	WINDOW A.C.	--	U.H. & CONV.	STEAM	--	359,190	--	--	10.1	9.2	9.0	3,000	
515	[illegible]	WINDOW A.C.	--	U.H. & CONV.	ELEC.	--	55,670	52 GAL.	ELEC	34.2	18.7	26.9	116,300	
A	[illegible]	--	--		STEAM	--	52,030	--	--	63.0	2.3	33.6	12,135	
91	[illegible]	--	--	CONV.	STEAM	-	101,601	--	--	65.0	12.0	55.0	22,135	
93	[illegible]	--	--	[illegible]	STEAM	--	101,493	--	--	774.3	82.2	610.6	602,300	
C1	[illegible]	-	--	U.H. & CONV.	STEAM	--	172,600	--	--	190.7	11.5	103.8	169,527	
C5	[illegible]	--	--	U.H. & CONV.	STEAM	--	172,600	--	--	190.7	11.5	107.0	169,527	

[illegible] A. M. KINNEY, INC. [illegible]
[illegible] CONSULTING ENGINEERS
[illegible] AREA "B"

BUILDING DATA SHEET
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[illegible]

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰
BLDG NO	NAME	NO FLOORS	YEAR BUILT	CONSTRUCTION					"U" VALUE					WINDOW AREA SQ FEET	DOOR AREA SQ FEET	FLOOR AREA SQ FEET
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR			
[illegible]	[illegible]	2	1961	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	1,200	203	6,025
[illegible]	[illegible]	2 & BSMT	1962	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	4,016	151	10,290
[illegible]	[illegible]	2 & BSMT	1962	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	4,016	151	10,000
[illegible]	[illegible]	2 & BSMT	1962	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	4,016	151	10,000
[illegible]	[illegible]	3	1961	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	1,250	156	5,233
[illegible]	[illegible]	2	1961	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	1,250	156	5,310
[illegible]	[illegible]	2	1961	B.U. ON WOOD	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	5,250	156	5,310
[illegible]	[illegible]	2	1961	B.U. ON WOOD	MASONRY	CONC.	[illegible]	WOOD	.035	.417	--	1.10	.50	1,250	156	5,330
[illegible]	[illegible]	1	1962	METAL ON WOOD	[illegible]	CONC.	METAL AWNING	HOLLOW METAL	.333	.417	--	1.10	.50	907	252	9,110
[illegible]	[illegible]	1	1961	METAL [illegible]	[illegible]	CONC.	METAL AWNING	HOLLOW METAL	.333	.417	--	1.10	.50	907	252	9,110
[illegible]	[illegible]	3	1962	B.U. ON CONC.	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	3,100	106	10,132
[illegible]	[illegible]	3	1962	B.U. ON CONC.	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	3,100	106	10,132
[illegible]	[illegible]	3	1962	B.U. ON CONC.	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	3,100	106	10,132
[illegible]	[illegible]	3	1962	B.U. ON CONC.	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	--	1.10	.50	3,100	106	10,132
[illegible]	[illegible]	3	1962	B.U. ON CONC.	MASONRY	CONC.	METAL AWNING	WOOD	.035	.417	-	1.10	.50	3,100	106	10,132
[illegible]	[illegible]	1-1/2	1960	B.U. ON WOOD	WOOD FRAME	CONC.	METAL AWNING	WOOD	.035	.310	--	1.10	.50	700	203	2,312
[illegible]	[illegible]	1-1/2	1960	B.U. ON WOOD	WOOD FRAME	CONC.	METAL AWNING	WOOD	.035	.318	--	1.10	.50	700	240	2,313
[illegible]	[illegible]	1-1/2	1960	B.U. ON WOOD	WOOD FRAME	CONC.	METAL AWNING	WOOD	.035	.310	--	1.10	.50	700	240	2,313
[illegible]	[illegible]	1-1/2	1960	B.U. ON WOOD	WOOD FRAME	CONC.	METAL AWNING	WOOD	.035	.318	--	1.10	.50	700	240	2,313
[illegible]	[illegible]	1-1/2	1960	B.U. ON WOOD	WOOD FRAME	CONC.	METAL AWNING	WOOD	.035	.310	--	1.10	.50	700	240	2,313
[illegible]	[illegible]	2	1961	B.U. ON WOOD	WOOD FRAME	CONC.	WOOD AWNING	WOOD	.035	.300	-	1.10	.50	501	326	5,100
[illegible]	[illegible]	2	1961	B.U. ON WOOD	WOOD FRAME	CONC.	WOOD AWNING	WOOD	.035	.300	--	1.10	.50	501	326	5,100
[illegible]	[illegible]	2	1961	B.U. ON WOOD	WOOD FRAME	CONC.	WOOD AWNING	WOOD	.035	.300	--	1.10	.50	501	326	5,100
[illegible]	[illegible]	2	1961	B.U. ON WOOD	WOOD FRAME	CONC.	WOOD AWNING	WOOD	.035	.300	--	1.10	.50	501	326	5,100
[illegible]	[illegible]	2	1961	B.U. ON WOOD	WOOD FRAME	CONC.	WOOD AWNING	WOOD	.035	.300	--	1.10	.50	501	326	5,100

FOR CONTINUATION, SEE PART 2, PAGE 10 OF 12

[illegible] AFB A. M. KINNEY, INC. [illegible] 8/23/82
[illegible], TENN. [illegible] 8/24/82
BUILDING DATA - AREA "B"

BUILDING DATA SHEET
PAGE 10 OF 12

TABLE I - (CONTINUED) BUILDING DATA SHEETS - PART 2

COLUMN NO'S

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG NO	NAME	COOLING		HEATING		PEAK TRANS LOAD		DOMESTIC HOT WATER		CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
		SYSTEM	CAPACITY	SYSTEM	FUEL	GAIN	LOSS	CAPACITY	FUEL					
[illegible]	[illegible] PLANT	--	--	CONVECT	STEAM	--	207,955	--	--	167.6	15.5	220.1	103,010	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	126.3	19.3	209.0	102,075	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	126.3	19.3	209.0	102,075	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	126.3	19.3	209.0	102,075	
[illegible]	[illegible]	[illegible] A.C.	--	CONVECT	STEAM	--	[illegible]	--	--	207.6	13.6	229.9	159,700	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	207.6	13.6	229.9	159,700	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	207.6	13.6	229.9	159,700	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	207.6	13.6	229.9	159,700	
[illegible]	[illegible]	[illegible] A.C.	--	U.H.	STEAM	--	417,905	60 GPH	STEAM	67.9	67.2	61.1	429,910	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	412,905	60 GPH	STEAM	63.0	49.6	50.7	236,650	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	249.	25.0	192.0	133,311	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	128.8	24.6	111.0	401,300	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	151.3	30.6	122.0	200,300	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	120.3	40.2	125.9	121,700	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	[illegible]	--	--	107.3	26.0	130.9	220,150	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.3	0.3	99.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	99.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	99.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	99.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	99.6	93,770	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	31.1	19.5	36.5	182,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	32.0	13.0	30.2	181,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	31.5	30.2	25.1	176,300	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	30.5	27.6	31.6	184,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	60.4	15.0	23.	102,200	

A. M. Kinney, Inc.

AREA "B"

8/23/82

8/30/82

BUILDING DATA SHEET
PAGE 11 OF 12

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰
ORG. NO	NAME	NO FLOORS	YEAR BUILT	CONSTRUCTION					"U" VALUE					WINDOW AREA SQ FEET	DOOR AREA SQ FEET	FLOOR AREA SQ FEET
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR			
[illegible]	[illegible]	[illegible]	1963	B.U. ON WOOD	[illegible]	CONC.	[illegible]	WOOD	.035	.310	--	1.10	0.54	[illegible]	320	5,100
[illegible]	[illegible]	1	1963	B.U. ON WOOD	WOOD FRAME	CONC.	[illegible]	WOOD	.035	.318	--	1.10	.54	110	202	1,116
[illegible]	[illegible]	1	1963	B.U. ON WOOD	[illegible]	CONC.	[illegible]	WOOD	.035	.310	--	1.10	.54	116	470	925
[illegible]	[illegible]	2	1963	B.U. ON WOOD	[illegible]	CONC.	[illegible]	WOOD	.035	.310	--	1.10	.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	FRAME	CONC.	[illegible]	WOOD	.035	.310	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	WOOD FRAME	CONC.	[illegible]	WOOD	.035	.310	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	WOOD FRAME	CONC.	[illegible]	WOOD	.035	.310	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	[illegible]	[illegible]	[illegible]	WOOD	.035	.310	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	[illegible]	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1963	B.U. ON WOOD	FRAME	CONC.	[illegible]	[illegible]	.035	.300	--	1.10	0.54	[illegible]	326	3,100
[illegible]	[illegible]	2	1962	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	70	[illegible]	2,101
[illegible]	[illegible]	2	1962	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	[illegible]	229	2,709
[illegible]	[illegible]	2	1962	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	[illegible]	0.59	70	[illegible]	2,100
[illegible]	[illegible]	1	1962	B.U. ON WOOD	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	[illegible]	0.59	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	1961	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.079	.310	--	1.10	0.59	263	196	1,111
[illegible]	[illegible]	1	1963	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.079	.310	--	1.10	0.59	[illegible]	196	1,111
[illegible]	[illegible]	1	1963	METAL ON WOOD	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.316	[illegible]	--	1.10	0.59	1190	[illegible]	2,099
[illegible]	[illegible]	1	1963	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.064	.075	--	1.10	[illegible]	[illegible]	90	[illegible]
[illegible]	[illegible]	1	1962	METAL ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.079	.310	--	1.10	0.59	200	[illegible]	816
[illegible]	[illegible]	1	1962	B.U. ON WOOD	FRAME	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	166	90	[illegible]

FOR CONTINUATION, SEE PART 2, PAGE 12 OF 12

[illegible] [illegible]
[illegible] [illegible]
[illegible] BUILDING DATA

A. M. Kinney, Inc.
[illegible]
AREA "B"

[illegible] 8021
[illegible] 8/25/82
[illegible] 8/16/82

BUILDING DATA SHEET
PAGE 12 OF 12

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG. NO.	NAME	COOLING		HEATING		PEAK THERMAL LOAD		DOMESTIC HOT WATER		CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
		SYSTEM	CAPACITY	SYSTEM	FUEL	GAIN	LOSS	CAPACITY	FUEL					
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	30.0	10.2	30.3	100,330	
[illegible]	[illegible]	--	--	CONV AT	STEAM	--	130,015	--	--	30.5	12.1	27.8	136,300	
[illegible]	[illegible]	--	--	CONV AT	STEAM	--	110,300	--	--	30.2	6.3	24.2	129,000	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	33.2	18.2	35.3	131,200	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	33.2	10.2	35.3	104,200	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	30.3	10.2	35.3	192,200	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	66.3	17.6	61.9	432,960	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	301,005	--	--	66.3	15.0	63.0	234,000	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	291,992	-	-	66.6	10.2	62.1	236,200	
[illegible]	[illegible]	--	--	CONV AT FAN COIL	STEAM	--	291,992	--	--	90.8	10.2	62.3	236,200	
[illegible]	CALIBRATION BUILDING	--	--	U.H.	STEAM	--	184,301	--	--	37.9	2.3	22.4	124,999	
[illegible]	[illegible] BUILDING	--	--	U.H.	STEAM	--	237,200	--	--	42.7	12.6	30.1	190,900	
[illegible]	[illegible] BUILDING	--	--	U.H.	STEAM	--	187,791	--	--	31.2	10.2	30.1	196,200	
[illegible]	[illegible] BUILDING	--	--	U.H.	STEAM	--	257,200	--	--	30.0	11.5	27.0	112,300	
[illegible]	[illegible]	CENTRAL W.C.	60,000	FAN COIL	STEAM	--	79,005	40 GAL	STEAM	12.0	12.0	11.[illegible]	100,100	
[illegible]	[illegible]	--	--	FAN COIL	STEAM	--	79,005	40 GAL	STEAM	12.0	12.0	11.[illegible]	130,190	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	501,540	60 GPH	STEAM	50.1	52.1	50.[illegible]	630,400	
[illegible]	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	29,690	--	--	5.0	2.2	4.[illegible]	30,190	
[illegible]	[illegible]	--	--	CONV AT	STEAM	-	67,000	30 GAL	ELEC	2.0	1.9	2.[illegible]	1,555	
[illegible]	[illegible]	--	-	-	--	-		-	--	0.2	0.2	3.[illegible]	6,265	

2.0 EXISTING ENERGY CONSUMPTION

Figure 2 shows that for FY 1981, coal and electricity account for 99.3 percent of all the energy consumed at HAAP.

Figure 3 plots the coal and electrical consumptions for the base year 1975 through 1981. Also plotted is equivalent RDX production and heating degree days which are used for the adjusted energy consumption plot.

Table 2 lists the fourth quarter 1981 utility costs that were used as the basis for all economic studies in this report.

Table 3 shows the present building energy use for building heating.

Table 4 shows the present energy use for building cooling.

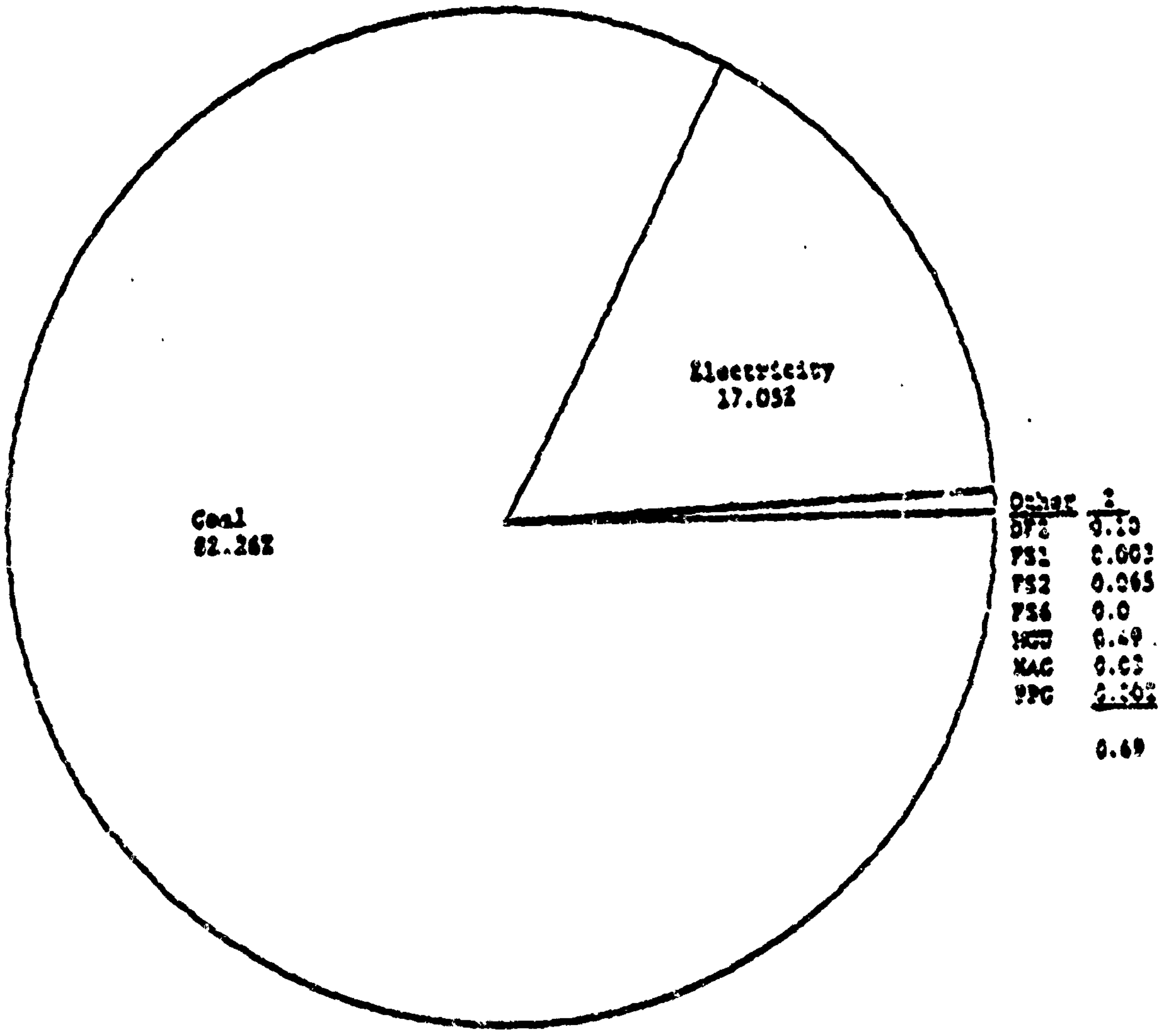
Table 5 shows the present energy use for domestic water heating.

HOLSTON ARMY AMMUNITION PLANT

FIGURE 2

Energy Consumption

FY-81 (Oct. 1980/Sept. 1981)



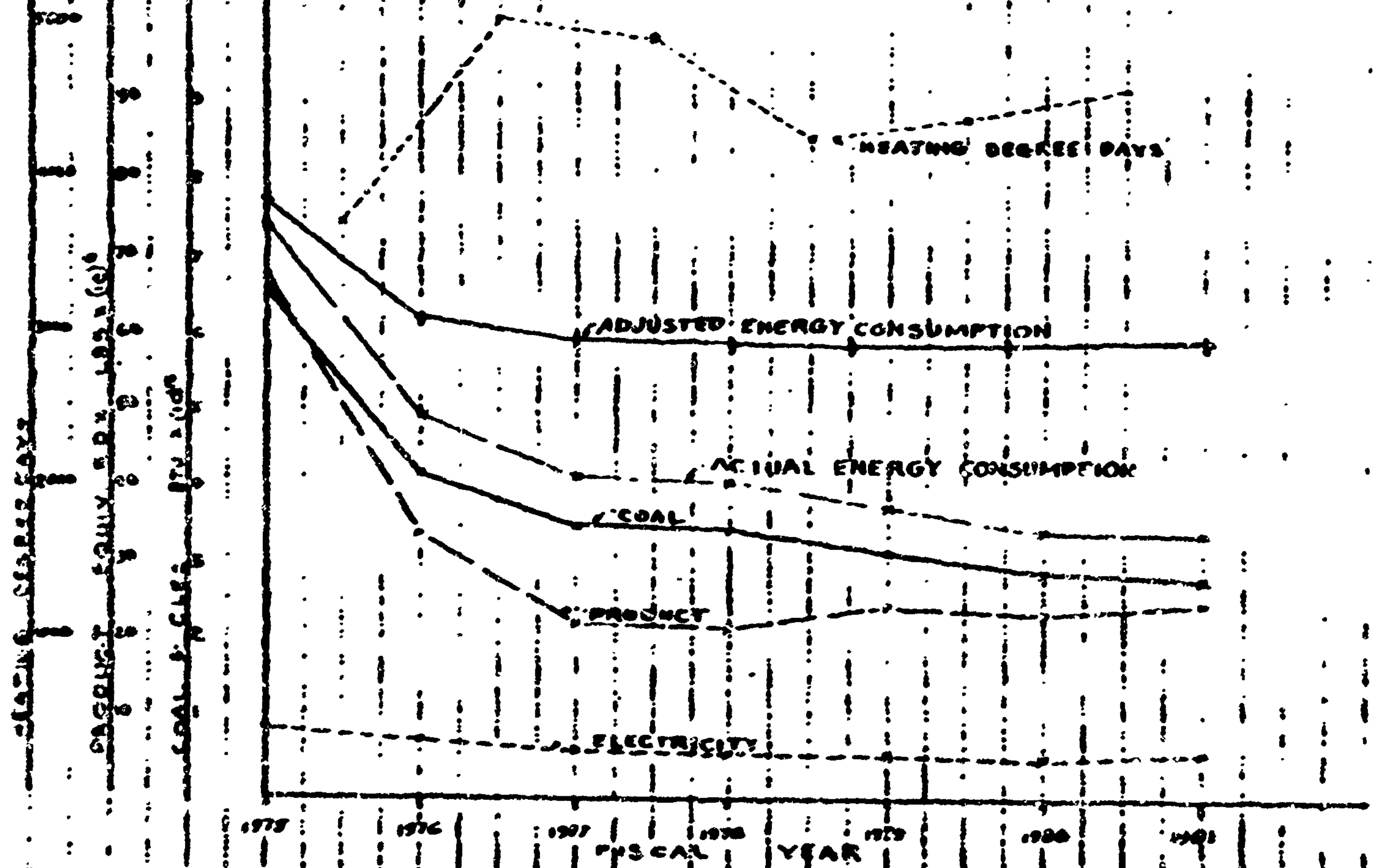
		MBtu	%	Total Dollar Cost
*Diesel fuel	DF2	3,761	0.10	$ —
Fuel oil	FS1	162	0.003	959
Fuel oil	FS2	2,347	0.065	6,361
Fuel oil	FS6	0	0.0	0
Coal, bituminous	COL	2,957,644	82.26	4,648,622
*Leaded motor gasoline	MGU	17,642	0.49	—
Purchased electricity	ELC	612,991	17.05	1,786,968
Natural gas	NAG	1,190	.03	818
Propane	PPG	86	0.002	802
TOTALS		3,595,286	100.0	$6,444,733

*Vehicular fuel

Job HOLSTON AAP
Location KINGSPORT, TENN.
Subject

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

File No. 2291 FIG Sh. No. 3
Checked by JWD Date 4-30-2
Computed by RAB Date 2-25-82



REF: HUC ACTUAL EXPERIENCE DATA

PURCHASED ENERGY
COMPARED TO
PRODUCT PRODUCTION & HEATING DEGREE DAYS
HOLSTON ARMY AMMUNITION PLANT

TABLE 2
HAAP UTILITY COSTS

4th Quarter FY 1985

Utility	Units	Area A	Area B
River Water	$/1,000 gal.	0.0234	0.0231
Filter Water	$/1,000 gal.	0.1415	0.1098
City Water	$/1,000 gal.	1.2935	0.5020
Compressed Air	$/1,000 cu.ft.	0.1965	0.036
Electricity	$/1,000 kWh	32.10	32.10
Steam	$/1,000 lb.	2.6740	2.6395

TABLE 3
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area A					
1	184,950	2,004	370.5	-	-
9	171,950	690	118.6	-	-
11	22[illegible],000	2,004	454.9	-	-
12	65,330	2,004	-	-	130.9
14	310,190	2,004	621.6	-	-
15	1,063,555	2,004	2,131.4	-	-
17	268,623	2,004	538.3	-	-
18	210,433	2,004	421.7	-	-
21	135,260	2,004	271.1	-	-
31	288,300	2,004	577.8	-	-
34	464,730	2,004	931.3	-	-
505	259,000	2,004	519.0	-	-
Area B					
2	401,369	1,420	569.9	-	-
4	550,425	2,334	1,294.[illegible]	-	-
6	403,532	2,004	808.7	-	-
7	524,656	2,004	-	-	1,05[illegible]
8	618,649	2,004	1,239.3	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
8A	129,092	2,004	258.7	-	-
3D	19,474	690	13.4	-	-
9	132,600	690	-	-	91.5
12	193,300	1,420	275.9	-	-
26	1,546,414	1,420	2,195.9	-	-
100	4,196,515	2,004	8,409.8	-	-
101	1,089,409	2,004	2,183.2	-	-
102	2,119,662	2,004	4,247.8	-	-
103	2,325,452	690	1,604.6	-	-
104	446,700	2,004	895.2	-	-
105	336,445	2,004	674.2	-	-
106	825,644	2,004	1,654.6	-	-
108	321,330	2,004	643.9	-	-
110	282,370	2,004	565.9	-	-
116	375,172	2,004	751.8	-	-
118	128,448	690	88.6	-	-
119	54,225	2,004	108.7	-	-
127	132,111	2,004	257.3		
135	117,953	2,004	236.4	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu)		
			Steam	Elect.	Oil
Area B					
136	92,338	2,004	185.4	-	-
150	240,957	690	166.2	-	-
151	449,855	690	310.4	-	-
155 (See T-1b)	308,814	2,004	-	154.7	-
156	507,575	1,420	720.7	-	-
157	62,728	2,004	125.7	-	-
203	657,824	2,004	1,318.3	-	1,318.3
216	75,600	690	52.2	-	-
219	236,553	2,004	474.1	-	-
224	89,026	690	61.4	-	-
231	85,976	690	59.3	-	-
235	736,568	50% @ 1,420	-	322.9	-
315	489,573	2,004	981.1	-	-
321	372,215	1,420	-	-	-
322	331,095	2,004	663.5	-	-
328 (See T-1a)	9[illegible],300	2,004	249.5	-	-
334	1,293,930	690	892.8	-	-
335	45,108	2,004	90.4	-	-
339	25[illegible],961	1,420	356.8	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
556	597,656	1,420	848.7	-	-
535	359,150	2,004	719.7	-	-
634	59,624	1,420	-	84.7	-
A	32,535	695	22.6	-	-
B-1	383,603	695	264.7	-	-
B-3	353,603	695	264.7	-	-
C-3	372,680	2,004	746.9	-	-
C-5	372,680	2,004	746.9	-	-
C-6	297,955	2,004	597.1	-	-
F-3	412,965	2,004	827.5	-	-
F-5	412,965	2,004	827.5	-	-
H-1	199,458	2,004	399.7	-	-
H-3	199,458	2,004	399.7	-	-
H-4	199,458	2,004	399.7	-	-
H-5	199,458	2,004	399.7	-	-
H-6	199,458	2,004	399.7	-	-
J-3	301,485	2,004	604.2	-	-
J-4	301,485	2,004	604.2	-	-
J-6	301,485	2,004	604.2	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu)		
			Steam	Elect.	Oil
Area 3					
J-3	301,485	2,004	604.2	-	-
J-4	301,485	2,004	604.2	-	-
J-5	301,485	2,004	604.2	-	-
K-3	130,875	2,004	262.3	-	-
K-5	114,340	2,004	229.1	-	-
L-3	301,485	2,004	604.2	-	-
L-4	301,485	2,004	604.2	-	-
L-6	301,485	2,004	604.2	-	-
M-3	301,485	2,004	604.2	-	-
M-4	301,485	2,004	604.2	-	-
M-5	301,485	2,004	604.2	-	-
M-6	301,485	2,004	604.2	-	-
N-3	182,701	2,004	366.1	-	-
N-4	257,280	2,004	515.6	-	-
N-5	182,701	2,004	366.1	-	-
N-6	257,280	2,004	515.6	-	-
O-3	76,085	2,004	152.5	-	-
O-5	76,085	2,004	152.5	-	-
P-3	503,540	2,004	1,009.1	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
R-3	29,690	2,004	59.5	-	-
W-1	47,846	2,004	95.9	-	-
Office (Sldg. Stor.)	13,619	2,004	-	27.3	-
Motor Control (Aerator)	16,080	690	-	11.1	-
Pump House (Sldg. Waste)	7,718	690	-	5.3	-
Motor Control (Digestor)	16,849	690	-	11.6	-
Motor Control (Filter)	11,363	690	-	7.8	-
Sldg. Trans. Pump Bldg.	22,584	690	-	15.6	-
Tank Drain Pump Bldg.	9,412	690	-	6.5	-
Land Fill Office	9,989	2,004	-	20.0	-
Elect. Bldg (Area A-1)	8,216	690	-	5.7	-
Compressor (Area A-1)	8,216	690	-	5.7	-
TOTALS			61,858.1	1,178.4	2,592.6
GRAND TOTAL			65,629.1 Mega Btu/year		

TABLE 4
PRESENT ENERGY USE FOR BUILDING COOLING

Bldg. No.	Design Day Heat Gain (Btu/Hour)	Annual Energy (Mega Btu) Fans	Condenser/ Chiller	Total
Area 3				
12	140,620	215.2	237.4	452.6
26	364,512	194.7	265.3	460.0
127	73,756	44.8	68.9	113.7
136 (Auto Din)	43,133	17.9	55.2	73.1
(Admin.)	76,064	39.0	81.9	120.9
(EAM Equip.)	59,840	33.4	81.4	114.8
155 (T-1b)	429,84[illegible]	307.9	461.9	769.8
156	127,481	91.3	137.0	228.3
235	249,776	58.5	244.3	302.8
328 (T-1a)	127,600	30.2	79.1	109.3
TOTAL				2,745.3

TABLE 3
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu) Steam	Annual Energy (Mega Btu) Elect.
Area A			
1	1.6	0.7	-
9	3.3	-	1.5
16	16.6	-	61.6
17	3.3	-	1.5
18	6.7	2.2	-
21	7.0	-	3.2
31	16.6	61.6	-
36	3.1	-	1.6
905	1.0	-	0.5
TOTALS AREA A	53.5	64.3	68.0
Area B			
2	5.9	-	2.7
6	11.5	-	5.3
7	27.3	-	12.5
8	25.7	11.7	-
12	15.6	-	7.1
26	66.3	-	30.4

TABLE 5 (CONT'D)
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu)	
		Steam	Elect.
Area B			
100	10.4	-	4.8
102	20.8	-	9.5
105	5.2	-	2.4
106	2,129.5	2,226.3	-
108	1,153.2	832.5	-
110	3.1	1.4	-
116	1.6	-	0.7
119	3.3	-	1.5
127	4.3	-	2.0
135	43.7	-	20.0
136	13.3	-	6.1
155	76.1	-	36.9
156	42.1	-	19.3
157	0.8	-	0.4
203	4.8	-	2.2
219	40.2	-	18.4
315	6.6	-	3.0
322	348.6	130.7	-

TABLE 5 (CONT'D)
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu) Steam	Annual Energy (Mega Btu) Elect.
Area B			
328	6.8	-	3.1
339	1.0	-	0.5
634	1.6	-	0.7
F-3	982.8	368.6	-
F-5	386.3	144.8	-
O-3	13.1	6.0	-
O-5	13.1	6.0	-
P-3	875.4	328.2	-
W-1	3.3	-	1.5
TOTALS AREA B	6,343.3	3,656.2	189.0
TOTALS			
Area A	53.5	66.3	68.0
Area B	6,343.3	3,656.2	189.0
TOTALS	6,396.8	3,722.5	257.0
GRAND TOTAL		3,979.5 Mega Btu	

3.3 ENERGY CONSERVATION MEASURES

The following areas were investigated for energy conservation:

a. Architectural. Air infiltration, insulation, storm windows, calking, weather stripping, entry vestibules, surplusing buildings.

b. Heating, Ventilation and Air-conditioning. Outside air dampers, variable air volume, window air-conditioners, recirculation fans, new air-conditioning units, steam heat, heat recovery, burning waste engine oil, cooling tower, radiator valves, air curtain, ductwork, unit heater setback and interlock air-conditioning with lights.

c. Electrical. Power factor correction, transformer core loss, demand peak limiting, relamping, refixturing and reballasting.

d. Plumbing. Shower heads, water heaters, heat recovery, heat pump, solar hot water heater.

e. Boiler House. Steam venting, combustion airflow, hot water drains.

f. Utilities. Steam piping insulation, condensate return, coal handling, turbulators, river water pumping, air compressors, biomass fuel, cogeneration, high temperature hot water, soot blowers.

6.0 ENERGY AND COST SAVINGS

Table 6 lists the energy conservation investment program projects and Facilities Engineer Energy Conservation Measures. All projects are to be in operation in FY 1989 unless otherwise noted.

TABLE 6
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ([illegible])	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
T-1	Building Energy Conservation Projects	175.8	89.6	5.1	2.1	15,750
T-2	Small Boiler Feedwater Pump - Area A	142.8	382.5	27.0	0.5	56,608
T-3	Small Boiler Feedwater Pump - Area B	170.0	131.1	9.2	1.5	22,285
T-4	Additional Insulation H.P. Steam Pipe - Area B	1,331.0	20.0	1.2	11.0	25,379
FE-ECM-1	Water Flow Restrictors	2.8	505.0	13.7	0.3	1,344
FE-ECM-2	Programmable Clock Controller	3.7	327.6	25.4	0.5	1,151
FE-ECM-3	Refixturing, Reballasting and Relamping Lights					
a.	Replacing Standard Fluorescent Lamps with High Efficiency Fluorescent Lamps - 8,736 Hr/Yr Lamps FY-84	0.729	500	3.44	0.5	365
b.	Refixturing Six Change Houses in Area B, 1983 Project	41.237	127	11.66	1.28	4,982
c.	Replacing Standard Fluorescent Lamps with High Efficiency Fluorescent Lamps - 2,600 Hr/Yr Lamps FY-90	1.257	105	5.55	1.2	127

TABLE 6 (CONT'D)
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ($1,000)	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
d.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-84	5,930	104	6.4	2.4	618
e.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-88	3.387	82.6	8.28	1.85	280
f.	Refixturing Six Office or Shop Buildings in Area B 1986 Project	42.609	75.4	7.67	1.89	2,838
g.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-91	6.233	69.4	10.9	1.5	436
h.	Refixturing Seven Buildings in Area A, 1986 Project	159.771	66.5	5.37	2.4	6,935
i.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 2,600 Hr/Yr Operation FY-88	26.191	24.6	2.46	5.2	644

TABLE 6 (CONT'D)
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ($1,000)	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
j.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 2,600 Hr/Yr Operation FY-91	53.061	20.6	2.98	5	1,095
k.	Replacing Existing Street Lighting Fixtures with High Pressure Sodium Fixtures Over a 10 Year Period (1983-1992)	14.519 to 24.529	8.6 to 5.1	2.3 to 2.76	4.8 to 4.3	126 to 126
FE-ECM-4	Feed Pump Recirc. Area A, FY-83	19.9	620	8.25	0.6	11,700
FE-ECM-5	Feed Pump Recirc. Area B, FY-83	19.9	331	4.4	1.1	6,243
FE-ECM-6	Feed Pump Recirc. Area B, Dec. - March FY-89	26.43	69.1	4.9	2.9	1,327
FE-ECM-7	Elect. Driven Deaerator Pump - Area A, FY-83	0	-	-	-	14,663
FE-ECM-8	Elect. Driven Deaerator Pump - Area B, FY-83	0	-	-	-	16,318
FE-ECM-9	Increase Deaerator Pressure - Area B, FY-83	0	-	-	-	7,768

5.5 INCREMENT A - ENERGY CONSERVATION INVESTIGATIONS FOR BUILDINGS

A survey of all buildings was made at the site to determine the condition of the buildings and to locate areas where building energy use could be improved.

This survey resulted in a number of Energy Conservation Measures which were developed into one overall ECIP for Building Energy Conservation Projects (ECIP T-1) consisting of:

a. Install a 12,000 Btu window air-conditioning unit in the shift foremen's office in Building No. 325 and reconnect existing steam heating radiator to existing low pressure steam line. The addition of the small air-conditioning unit to serve the shift foremen will allow the main building air-conditioning system to be shut down during nights and weekends.

b. Install a small air-conditioning unit and air-cooled condensing unit in Building No. 155 and modify existing ductwork, install temperature controls and electrical interlock with existing main air-conditioning unit. The addition of the small air-conditioning unit to serve the reduced number of building occupants during the night and weekend shifts will allow the main unit to be shut down during these periods.

c. Install electronic temperature programmers to automatically set back the thermostat setting of the unit heaters at four buildings in Area A and 15 buildings in Area B. For a list of buildings involved, see ECIP T-1 in Volume IV. The addition of these programmers will allow the unit heaters to operate at a lower temperature during night and weekend unoccupied hours.

d. Install variable frequency motor speed controllers on the supply and return fan motors on the variable air volume air-conditioning system in Building No. 26. The addition of the speed controllers will replace the use of constant speed fan motors with inlet dampers to control the volume of air handled by the system. The inlet vane dampers reduce the required power input to the motor somewhat; however, adding variable frequency controllers substantially reduces the required power input to the motor.

e. Install 3-1/2 inches of insulation to the underside of uninsulated floors that are over unheated crawl spaces in Buildings No. 2, 4 and 6. The addition of this insulation will reduce the building heat loss during the winter heating season.

f. Install an entrance vestibule at an exterior door and limit the use of all other exterior doors as emergency exits only, in the change houses, Buildings No. 14, 21, 31, 108, 135, 136, 219, 323, F-3, F-5 and P-3. The addition of vestibules and restricting the use of the other doors will reduce the amount of air infiltration in the winter, thus reducing the amount of building heat required.

g. Install automatic temperature control valves on steam heating radiators in Building No. 1 in Area A and Building No. 5 in Area B to thermostatically control the steam supply. The automatic control valves will replace existing manual shutoff valves. The addition of the automatic temperature control valves will allow for accurate space temperature control, preventing overheating, thus saving on the use of steam.

6.0 INCREMENT B - ENERGY CONSERVATION INVESTIGATIONS OF UTILITIES DISTRIBUTION SYSTEMS, EMCS

Increment B is the study of all on-Base utility systems and the consideration of Energy Monitoring Control Systems (EMCS).

The on-Base utility systems are generally in good repair. The systems have been reviewed and improved in the past for energy conservation. The following are the energy conservation recommendations and conclusions resulting from this study:

a. Install additional insulation to the high pressure steam distribution piping in Area B.

b. It is not economical to add additional insulation to the high pressure steam distribution piping in Area A or the low pressure steam distribution piping in Area B.

c. It is not economical to install a condensate return system in Area B.

d. Continue the steam trap maintenance program.

e. Install smaller turbine-driven boiler feedwater pumps in both Area A and Area B boiler houses.

f. Install a boiler blowdown heat exchanger in the flash tank drain after the excess steam venting from the 5 psig steam system is eliminated.

g. Installation of turbulators in Area A waste heat boilers is not justified at the present low steam load.

h. Continue to monitor the recently implemented program to not operate the low head river water pump.

i. Incorporate, in future replacement of air compressors, an air dryer that utilizes the heat of compression.

j. A Base-wide Energy Monitoring and Controls System (EMCS) was investigated, but was found to be not feasible at this plant due to the limited energy savings which would be accomplished, and to the higher than average cost of transmitting the control and reporting signals over the long distances involved.

Local time clock controls are recommended for individual buildings.

7.0 INCREMENT E (MOD) - CENTRAL BOILER PLANTS

Increment E (Mod) is a program of modernization for existing central boiler plants. HAAP is served by similar central boiler plants in Area A and Area B, which are each about 40 years old and located about 6.3 miles apart. See Map, Figure 1, Page 2.

The coal-fired boilers are generally in excellent operating condition. The boilers have been derated due to a lack of fan capacity to handle the added particulate removal equipment. Each steam plant is capable of meeting the approved mobilization plan (Sierra VI), assuming the electrostatic precipitators with the pulverized coal-fired boilers are repaired or replaced as previously planned.

7.1 Existing Plans

It is recommended that the following existing plans be implemented:

a. Modernize the coal handling systems.

b. Continue the program of adding boiler overfire air systems to the stoker-fired boilers.

c. Add an oxygen analyzer to one boiler to help control excess combustion air on a test basis.

d. Replace the above mentioned electrostatic precipitators.

7.2 Results

The following is recommended or concluded as a result of the Increment E (Mod) investigation:

a. Biomass, in the form of wood, could be burned in the Area B stoker-fired boilers. This requires the addition of wood handling equipment to the proposed coal handling system.

b. Install a cogenerating turbine generator in Building B-6, Area B. Convert the existing high pressure steam header north of the G buildings to a low pressure steam header connecting the turbine generator to new distribution piping to the production buildings presently in operation.

c. The soot blower controls should be automated.

d. All boilers not required to be operated should be placed in a true layaway condition.

e. The boiler combustion air to the forced draft fan should be ducted from outside in the winter and from the upper areas of the boiler house in the summer.

f. No attempt should be made to burn any fuel other than natural gas or oil in the presently laid-away boilers in Building No. 222.

g. The existing ash handling systems are adequate even though they do not reflect the latest removal methods normally found in plants of this size.

h. Installation of a high temperature hot water heating system for modernization purposes is not feasible.

8.0 INCREMENT F - FACILITIES ENGINEER ENERGY CONSERVATION MEASURES (FE-ECM)

Increment F develops recommendations that can be used to update the Installation Base-wide Energy Systems Plan. These recommendations include changes, alterations or modifications to systems operations that are under the control and funding authority of the Facilities Engineer.

The following are the recommendations resulting from this study:

a. Reduce the excess low pressure steam venting to atmosphere from each boiler house by incorporating the following operational modifications:

(1) Operate the motor driven deaerator feedwater pump with the turbine-driven pump on warm standby in both Area A and Area B boiler houses.

(2) Reduce the boiler blowdown flows to the minimum acceptable level.

(3) Increase the Area B deaerator and low pressure steam system pressure.

b. Programmable time clocks with temperature setback are recommended for individual buildings.

c. Water flow restricters are recommended for the shower heads at all change houses and other areas where shower facilities are provided.

d. Reballasting, relamping and refixturing are recommended for all buildings as replacements are required.

e. Additional training of personnel is not required.

9.0 INCREMENT G - NON-ECIP MAINTENANCE, REPAIR AND MINOR CONSTRUCTION PROJECTS

Increment G is the identification of non-ECIP maintenance, repair and minor construction projects.

The level of maintenance presently performed at HAAP is typical of a well-run chemical plant.

One major maintenance item was found. The multiport relief valve in each boiler house low pressure steam system should be inspected for leakage after it has been determined that high pressure steam is required for makeup to the low pressure system.

It is recommended that an automatic recirculation control system be installed in each boiler feedwater pump recirculation line as a minor construction project in order to reduce the excess low pressure steam venting. Automatic shutoff of the recirculation flow at feedwater flows above the pump minimum flow will reduce the pump horsepower requirements, which will reduce the turbine exhaust low pressure steam flow.